INCH-POUND

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PERFORMANCE SPECIFICATION

TEST PROGRAM SETS

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the technical requirements for Test Program Sets (TPSs) (see 6.4.25).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

Beneficial comments (recommendations, additions, deletions) and any other pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Air Warfare Center Aircraft Division, (Code 414100B120-3), Highway 547, Lakehurst, NJ 08733-5100, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

AREA ATTS

2.2 Government documents.

2.2.1 Specification. The following specification forms a part of this document to the extent specified herein. Unless otherwise specified, the issue of this document is that listed in the issue of the Department of Defense Index of Specification and Standards (DoDISS) and supplements thereto, cited in the solicitation (see 6.2).

SPECIFICATION

DEPARTMENT OF DEFENSE

MIL-PRF-28800 - Test Equipment for use with Electrical and Electronic Equipment, General Specification for.

(Unless otherwise indicated, copies of the above specification are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME-Y14.38 - Abbreviations and Acronyms. (DoD adopted)

(Application for copies should be addressed to the American Society of Mechanical Engineers, 3 Park Avenue, New York, NY 10016.)

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA-625 - Requirements for Handling Electrostatic-Discharge-Sensitive (ESDS) Devices.

(Application for copies should be addressed to the Electronics Industry Alliance, 2500 Wilson Boulevard, Arlington, VA 22201-3834.)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE-200 - Electrical and Electronics Parts and Equipment, Reference Designations for. (DoD adopted)

IEEE-315 - Graphic Symbols for Electrical and Electronics Diagrams. (DoD adopted)

(Application for copies should be addressed to the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331.)

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC-CISPR-11 - Industrial, Scientific and Medical (ISM) Radio - Frequency Equipment - Electromagnetic Disturbance Characteristics - Limits and Methods of Measurement.

IEC-61000-4-2 - Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement Techniques - Electrostatic Discharge Immunity Test.

IEC-61000-4-3 - Electromagnetic Compatibility (EMC) - Part 4-3: Testing and Measurement Techniques - Radiated, Radio - Frequency, Electromagnetic Field Immunity Test.

IEC-61000-4-4 - Electromagnetic Compatibility (EMC) - Part 4: Testing and Measurement Techniques - Section 4: Electrical Fast Transient/Burst Immunity Test. Basic EMC Publication.

IEC-61000-4-6 - Electromagnetic Compatibility (EMC) - Part 4-6: Testing and Measurement Techniques - Immunity to Conducted Disturbances, Induced by Radio - Frequency Fields.

(Applications for copies should be addressed to the International Electrotechnical Commission, 3 rue de Varembe, P.O. Box 131, 1211 Geneva 20, Switzerland.)

INSTRUMENTATION, SYSTEMS, AND AUTOMATION SOCIETY (ISA)

ISA-S82.02.01 - Safety Standard for Electrical and Electronic Test, Measuring, Controlling, and Related Equipment - General Requirements.

ISA-S82.02.02 - Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use.

(Application for copies should be addressed to the Instrumentation, Systems, and Automation Society, 67 Alexander Drive, P.O. Box 12277, Research Triangle Park, NC 27709.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a TPS shall be subjected to first article inspection in accordance with 4.2.

3.2 Performance characteristics. The TPS shall be operated and maintained by typical operating personnel (see 6.4.29). No additional test hardware, active components, or manual testing shall be used to comply with requirements of this specification without prior approval from the acquisition authority.

3.2.1 TPS transportability. The TPS shall be transportable and operate with the designated Unit Under Test (UUT) with all Automatic Test Equipment (ATE) of the same configuration without revisions or modifications to the TPS or ATE (see 6.4.25 and 6.4.28).

3.2.2. TPS test accuracy ratio. The TPS shall exhibit a minimum measurement Test Accuracy Ratio (TAR) of 3:1 and a minimum stimulus TAR of 1:1 (see 6.4.21).

3.2.3. TPS set-up time. The TPS shall have a set-up time not greater than ten minutes (see 6.4.26).

3.2.4 TPS safety. The TPS when connected, operated (in the off or any operational mode), and disconnected shall meet the following safety requirements in accordance with ISA-S82.02: electric shock and mechanical hazards; equipment temperature limits and protection against the spread of fire; resistance to heat, component safety, and electric shock from measuring currents.

3.2.5 UUT and ATE integrity. The TPS shall maintain UUT and ATE integrity and not change hardware and software functions and capabilities of a UUT or ATE. Software functions of the UUT shall only be changed when reprogramming, reloading or updating UUT firmware (see 6.4.31).

3.2.6 Environment. The TPS shall meet the electromagnetic interference, shock, vibration, and storage requirements of the ATE (see 6.2).

3.2.7 Technical architecture interface requirements. Any element of the technical architecture that is implemented shall not be bypassed by a direct communication to another interface or layer further on in the process.

3.3 Test Program (TP) format. The TP format requirements shall be used when Abbreviated Test Language for All Systems (ATLAS) is used as the TP software language. The standard messages in 3.3.8 shall be used when any language is used for the TP software (see 6.4.23).

3.3.1 Test Statement Number (TSN). Each ATLAS executable signal oriented statement shall be assigned a six-digit TSN. The first four numbers represent the test number. The last two

numbers represent the step number. TSNs ending in 00 shall be reserved for the first statement in a test. TSNs, during the development of the TP, shall be assigned in increments of not less than five to allow later corrections or modifications to the TP. TSNs shall be in sequential order and shall not be resequenced after acceptance for configuration management. The first statement of each subroutine procedure definition shall have a TSN. The TSN shall:

a. Range from 000100 to 099999 and include the preamble and if required, the ATE survey test (see 6.4.4).

b. Be assigned 100000 for the first entry point.

c. Increment performance test groups by one-hundred (010000).

d. Increment by ten (001000) within performance tests.

e. After the diagnostic test; be numbered from 900000 to 999999 for program termination code, and output to administrative data (see 6.4.10).

3.3.2 Variable names. Variable names shall reflect the primary attribute of the data that the variable represents. Variable names which represent a unit of measurement or which represent an attribute or element of the UUT shall take precedence over generic names; such as reading. Variable names shall use the standard abbreviation for the items listed in ASME-Y14.38.

3.3.3 ATLAS procedures. ATLAS procedures shall be used to perform specific functions. The name of each procedure shall reflect the function of the block of ATLAS code from which the procedure is invoked. All ATLAS programs shall use the following standard procedure names, when applicable.

a. TPSINFO - displays the TPS and UUT Identification data to the ATE operator and requires the ATE operator verification.

b. IDHOOKUP - instructs the ATE operator to connect and install the Test Program Hardware (TPH) on the target ATE.

c. UUTHOOKUP - instructs the ATE operator to connect and install the UUT on the TPH.

d. REPLACE - instructs the ATE operator to remove and replace faulty components or assemblies from the UUT (diagnostic callout of faulty devices).

e. PROBE - instructs the ATE operator to connect a probe to a point on the UUT.

f. POWERON - contains the ATLAS instructions to apply all power to the UUT.

g. POWEROFF - contains the ATLAS instructions to remove all power from the UUT.

3.3.4 Looping statements. The TP shall utilize indentation of each ATLAS statement within each loop by two spaces until the termination of each loop. For each loop, the end statement shall be aligned with the initiation of the loop. The nesting of loops shall be not greater than three levels.

3.3.5 ATLAS comments. Four types of comments shall be used.

3.3.5.1 Major comment header. Major comment headers shall be used to both separate and identify major sections of coding throughout the TP. The format of a major comment header shall be a centered rectangle of asterisks, with minimum dimensions of 5 X 50 asterisks, containing a short, functional description of the block of code that is underlined and in capital letters. At least one blank line shall appear both before and after each major comment header. The minimum use of major comment headers shall be as specified in 3.3.7, but this technique may be used anywhere throughout the program to enhance readability of the code. An example of a major comment header is shown on figure 1.

3.3.5.2 Minor comment header. Minor comment headers shall be used to identify the function of each module of code within the TP. These headers shall consist of one or more lines, convey the function of the code, and shall be centered and in capital letters. Each line shall consist of five asterisks, followed by five blank spaces, followed by the text of the comment, followed by five additional blank spaces, followed by five asterisks. At least one blank line shall appear both before and after each minor comment header. Within the ATE survey tests (if required), TPH tests and UUT pre-performance tests, each test shall have a minor comment header to identify the circuitry or components being tested. Within the UUT performance tests, each performance test shall use a minor comment header to identify the UUT function being tested, as well as a reference to the applicable testing specification paragraph (see 6.4.17). Within the UUT diagnostic tests, a minor comment header shall be used to identify the area of diagnosis on the UUT as well as to identify the performance test or tests which, upon failure, that cause the program to branch to the particular diagnostic test. Other areas requiring minor comment headers are specified in 3.3.7.1 and 3.3.7.2. An example of a minor comment header is shown on figure 2.

3.3.5.3 Functional comments. Functional comments shall be used within a module of code to enhance the readability of the code. Functional comments shall be UUT oriented. For example, if an automatic frequency generator is used to create a waveform required for UUT testing, a functional comment shall be used to describe the waveform and to relate back to the requirement of the specification. Functional comments shall explain the logic flow of the UUT diagnostic tests, stimuli applications, and the evaluation of measurements. Functional comments shall consist of one or more centered, sentence case lines as required to convey the function of the code. Each line shall consist of five asterisks, followed by five blank spaces, followed by the text of the comment, followed by five asterisks. At least one blank line shall appear both before and after each functional comment header. An example of a functional comment is shown on figure 3.

3.3.5.4 Procedural comments. Procedural comments shall be used within modules of code and shall describe the program flow. For example, if the program queries the operator that the program will branch to different sections of code depending upon the response, a procedural comment shall be used to correlate the branches to the possible responses. All branching statements shall include a procedural comment to explain the branch.

3.3.6 ATLAS preamble structure.

3.3.6.1 TP title block. The first element of the preamble shall be the TP title block. The TP title block shall be located immediately after the termination of the ATLAS statement BEGIN, and include the program name, the UUT name and part number, the weapon system(s) using the UUT, and the Line Replaceable Unit (LRU) from which the UUT is derived, if applicable. Asterisks shall border the entire title block so that it is further emphasized. Asterisks within the title block shall also border the program name. The title block shall be spaced so that, with the ATLAS statement BEGIN, it shall occupy the entire first page of the source listing when it is printed on a standard hard copy device. An example of the title block is shown on figure 4 (see 6.4.27).

3.3.6.2 UUT configuration data. The second element of the preamble shall be the UUT configuration data (see 6.4.30). For each item of source data, this comment shall list the drawing number, the revision level of the drawing, the latest date of the drawing, and the type of the drawing. If the drawing is an original (no revision level), this shall be designated by the term ORIG in the revision column. The UUT configuration data shall immediately follow the TP title block, be centered and in capital letters. An example of the UUT configuration data comment is shown on figure 5.

3.3.6.3 TP configuration data. The third element of the preamble shall be the TP configuration data. The TP configuration data block shall be preceded by a major comment header and shall identify all changes made to the TP after the product baseline. This block shall provide a complete history of all software changes made to the TP. The TP configuration data shall immediately follow the UUT configuration data. An example of TP configuration data block is shown on figure 6.

3.3.6.4 Entry Point Directory (EPD). The fourth element of the preamble shall be the EPD. The entry point directory shall be bordered by asterisks and contain a complete listing of all entry points which are available to the TPS developer or TPS maintainer to speed access to applicable sections of the TP. This directory shall be a superset of those entry points available to the TPS operator through the TPS MENU screen. The selection of an entry point from the EPD, shall cause the TP to go to that entry point in the TP. Entry points shall be designed into the program at the beginning of each functional block of tests. All modules with entry points shall not be dependent on stimuli application or indicator initialization which occurs prior to the entry point. The EPD shall immediately follow the TP configuration data. An example of the EPD is shown on figure 7.

3.3.6.5 ATLAS include statements. The fifth element of the preamble shall be a block of code reserved for any ATLAS include statements. This section shall be preceded by a major comment header containing the underlined words INCLUDE STATEMENTS. This comment header shall then be followed by the applicable ATLAS instructions. The ATLAS include statements shall immediately follow the entry point directory.

3.3.6.6 ATLAS require statements. The sixth element of the preamble shall be a block of code reserved for the ATLAS require statements. This section shall be preceded by a major comment header containing the underlined words REQUIRE STATEMENTS. This comment header shall then be followed by the applicable ATLAS instructions. The ATLAS require statements shall immediately follow the include statements.

3.3.6.7 ATLAS variable declarations. The seventh element of the preamble shall be a block of code for the declaration of variables. This section shall be preceded by a major comment header containing the underlined words DECLARE STATEMENTS. This comment header shall then be followed by the applicable ATLAS instructions for the declaration of all variables used globally throughout the program. The ATLAS variable declarations shall immediately follow the require statements.

3.3.6.8 Interface definitions. The eighth element of the preamble shall be a block of code for the interface definitions, if applicable. This section of code, which contains the ATLAS define and interface statements, shall be preceded by a major comment header containing the underlined words INTERFACE DEFINITIONS. The interface definitions shall immediately follow the ATLAS variable declarations.

3.3.6.9 ATLAS fill statements. The ninth element of the preamble shall be a block of code for data initialization for all global variables. A major comment header containing the underlined words FILL STATEMENTS shall precede this section. The ATLAS fill statements shall immediately follow the interface definitions.

3.3.6.10 ATLAS message definitions. The tenth element of the preamble shall be a block for the definition of messages. This section of code, which contains the ATLAS define and message statements, shall be preceded by a major comment header containing the underlined words MESSAGE DEFINITIONS. The ATLAS message definitions shall immediately follow the ATLAS fill statements.

3.3.6.11 ATLAS procedure definitions. The eleventh element and final section of the preamble shall be a block for the definitions of ATLAS procedures. This section shall be preceded by a major comment header containing the underlined word PROCEDURES. Within this section, each procedure to be used globally throughout the program shall be defined using the applicable ATLAS instructions. Prior to each procedure a minor comment header shall be used to provide specific information regarding the function or utilization of the procedure. The ATLAS procedure definitions shall immediately follow the ATLAS message definitions.

3.3.7 UUT verification section. The next section of the TP shall be the UUT verification section. This section shall be preceded in the source code with a major comment header containing the underlined words UUT VERIFICATION. The executable ATLAS code required to generate the standard TPS menu screen shall follow this comment. When executed this code shall display the UUT name and the UUT assembly or part number.

3.3.7.1 TPH tests. The TPH tests shall be preceded in the source code by a major comment header containing the underlined words TPH TESTS. The TPH tests shall consist of four parts: the TPH idhookup; the TPH signature test; the TPH Safe-To-Turn-On (STTO) test and the TPH survey test, in that order. Each of these parts shall be preceded in the source code with a minor comment header identifying the section of code consistent with the comment and coding requirements of 3.3.5.2.

3.3.7.2 UUT tests. UUT tests shall consist of: UUT hookup; UUT pre-performance test; UUT performance test section; and UUT diagnostic tests section. The beginning of each of these sections shall be denoted in the source code by a major comment header containing the underlined title of the section. The UUT pre-performance test shall consist of the UUT signature test and the UUT STTO tests. Each of these sections of code shall also be denoted by a major comment header containing the applicable title underlined. Individual tests within each of the categories shall be denoted in the source code by a minor comment header identifying the section of code consistent with the comment and coding requirements of 3.3.5.2.

3.3.8 Standard messages. The following standard messages shall be formatted for use with the target ATE video display.

a. ATE operator adjustment/alignment message:
   Message header - OPERATOR INSTRUCTION - ADJUSTMENT REQUIRED.
   Message content - American Standard Code For Information Interchange (ASCII) text description of the action to be performed.
   Message footer - ASCII text description of the action required to exit the adjustment procedure.

b. ATE operator decision message:
   Message header - OPERATOR INSTRUCTION - DECISION REQUIRED.
   Message content - ASCII text description of the decision criteria, including the action required to execute the decision.

c. ATE operator setup message:
   Message header - OPERATOR INSTRUCTION - SETUP REQUIRED.
   Message content - ASCII text description of the setup action to be performed.
   Message footer - ASCII text description of the action required to exit the setup procedure.

d. Electrostatic Sensitive Devices (ESD) warning message:
Message header - CAUTION
Message content - UUT CONTAINS ELECTROSTATIC SENSITIVE DEVICES. FOLLOW ESD HANDLING PROCEDURES.
Message footer - ASCII text description of the action required to exit the message display.

e. Power on message (less than 30 volts):
Message header - NOTE.
Message content- (actual voltage value) VOLTS PRESENT
Message footer - ASCII text description of the action required to exit the message display.

f. Power on warning message (greater than 30 volts and less than 500 volts):
Message header - WARNING.
Message content - (actual voltage value) VOLTS PRESENT
Message footer - ASCII text description of the action required to exit the message display.

g. Power on danger message (greater than 500 volts):
Message header - DANGER
Message content - (actual voltage value) VOLTS PRESENT
Message footer - ASCII text description of the action required to exit the message display.

h. Power off message:
Message header - UUT POWER OFF.
Message content - ALL POWER HAS BEEN REMOVED.
Message footer - ASCII text description of the action required to exit the message display.

i. UUT pass end of program message:
Message header - END OF PROGRAM - UUT GOOD.
Message content - UUT HAS PASSED ALL PERFORMANCE TESTS.
Message footer - ASCII text description of the action required to exit the message display.

j. UUT failed end of program message:
Message header - END OF PROGRAM - UUT FAULTY.
Message content - UUT DID NOT COMPLETE ALL PERFORMANCE TESTS.
Message footer - ASCII text description of the action required to exit the message display.

k. TPH/UUT hookup message:
Message header - OPERATOR INSTRUCTION - ACTION REQUIRED.

Message content- ASCII text description of the TPH/UUT hardware connections to be performed.
Message footer - ASCII text description of the action required to exit the message display.

l. TPH/UUT disconnect message:
Message header - OPERATOR INSTRUCTION - ACTION REQUIRED.
Message content- ASCII text description of the TPH/UUT hardware removal to be performed.
Message footer - ASCII text description of the action required to exit the message display.

m. Classified confidential warning message:
Message header - CLASSIFIED INFORMATION.
Message content - CLASSIFIED SECURITY CLEARANCE REQUIRED. FOLLOW SECURITY PROCEDURES.
Message footer - ASCII text description of the action required to exit the message display.

n. Classified secret warning message:
Message header - CLASSIFIED INFORMATION.
Message content - SECRET SECURITY CLEARANCE REQUIRED. FOLLOW SECURITY PROCEDURES.
Message footer - ASCII text description of the action required to exit the message display.

o. Fault callout message (displayed on the target ATE video display and printed on the target ATE printer):
Message header - REMOVE AND REPLACE.
Message content - LISTED IN PROBABLE ORDER OF FAILURE:
ASCII text listing by reference designation the possible faulty circuit cards and/or components.
Message footer - ASCII text description of the action required to exit the message display, if applicable.

p. TPH pass end of program message:
Message header - END OF PROGRAM - TPH GOOD.
Message content - TPH HAS PASSED ALL PERFORMANCE TESTS.
Message footer - ASCII text description of the action required to exit the message display.

q. TPH failed end of program message:
Message header - END OF PROGRAM - TPH FAULTY.

Message content - TPH DID NOT COMPLETE ALL PERFORMANCE TESTS.
Message footer - ASCII text description of the action required to exit the message display.

3.4 Software.

3.4.1 Demonstration of TPS software.

3.4.1.1 TP menu. The TPS shall provide a TP menu on the ATE video display that includes the End-to-End (ETE) test, an individual test module, or TP termination. Upon the selection of one of these menu choices the TP shall:

a. remove power to the UUT and return to the menu to await operator action when ETE tests (performance tests with no faults being detected) are complete.

b. return to the menu to await operator action after successful execution of any selected individual test module.

c. cease operating when the operator selects TP termination (at an applicable part of the TP). Subsequent to termination, all power, stimulus, and measurement connections shall be removed from the UUT and the ATE shall be reset to an inactive state.

3.4.1.2 Printed information. The TPS shall provide a printed information option to allow printing of messages or test results.

3.4.1.3 Messages. The TPS shall display the standard messages of 3.3.8 on the ATE video display. The TPS shall successfully operate the ATE and advise the operator of hazardous conditions. The caution or warning messages, found in 3.3.8, shall precede all tests where potentially unsafe or hazardous conditions are present. The TPS shall require operators to acknowledge the message before continuing.

3.4.1.4 Graphics. The TPS shall provide graphics on the ATE video display of specific operations, procedures, and diagrams required for the ATE operator to conduct testing of the designated UUT. The systems interconnect diagrams and test set-up diagrams shall be displayed. All adjustment locations, alignment locations, test point locations, designated probe point locations, and additional test information, as they appear on the UUT, shall be displayed. All potentially unsafe hazardous points associated with test and diagnosis of the UUT or the TPH shall be identified by warning and caution messages.

3.4.2 TPH software.

3.4.2.1 TPH pre-performance tests. The TPH pre-performance test shall:

a. display the TPH connections on the ATE video display. All required hardware shall be identified by part number. All connections made between the TPH and the ATE shall be identified by system interconnect and test set-up diagrams.

b. perform a TPH signature test to confirm the correct TPH is connected to the ATE prior to a TPH STTO testing sequence. The applicable message specified in 3.3.8 shall be displayed on the ATE video display.

c. perform a TPH STTO test to check for conditions on power pins, power busses, or power switching assemblies that may cause damage to the TPH or the ATE. The applicable message specified in 3.3.8 confirming STTO shall be displayed on the ATE video display.

3.4.2.2 TPH performance test. The TPH performance test shall:

a. have a run time interval not greater than ten minutes between program entry points.

b. have a wraparound test that is performed with the UUT disconnected from the TPH and the UUT interface wrapped around to the TPH and ATE via shorting plugs or cables, as applicable.

c. detect all TPH faults, including wire paths.

d. contain modules that provide test segregation to allow individual testing of each specific UUT's applicable TPH circuitry.

e. be performed without removing TPH covers, using TPH extender boards, and probing of the TPH.

f. not require an additional interface device (ID).

3.4.2.3 TPH test repeatability. The TP shall allow the ATE operator to repeat or cycle each test and test condition. A TPH GOOD message shall not result if a test is repeated due to a failed performance test.

3.4.2.4 TPH programmable parts. The TP shall erase and reprogram all programmable TPH components. This process shall be accomplished by operator selectable routines in case of component failure or firmware updates.

3.4.2.5 TPH diagnostic test. The TPH diagnostic test shall:

a. isolate detected faults to a single component or a single non-repairable assembly and shall cause display and listing of the failed component.

b. fault isolate to the failed wire path and shall identify all components in the failed wire path, including cables.

c. not require probing, adjustment, and alignment procedures.

3.4.3 UUT software.

3.4.3.1 UUT pre-performance test. The UUT pre-performance test shall:

a. display the UUT connections on the ATE video display. All required hardware shall be identified by part number. All connections made between the UUT, TPH, and the ATE shall be identified by system interconnect and test set-up diagrams.

b. perform a UUT signature test to confirm the correct UUT is connected to the ATE prior to a UUT STTO testing sequence. The applicable message specified in 3.3.8 confirming a correct connection shall be displayed on the ATE video display.

c. perform a UUT STTO test to check for conditions on power pins, power busses, or power switching assemblies that may cause damage to the UUT, TPH, or ATE. The applicable message specified in 3.3.8 confirming STTO shall be displayed on the ATE video display.

3.4.3.2 UUT performance test. The UUT performance test shall:

a. have an ETE test run time less than 60 minutes for LRU UUTs and less than 15 minutes for Shop Replaceable Assembly (SRA) UUTs, with no faults being detected (see 6.4.19). Performance tests time shall be measured from the start of UUT tests, after TPS set-up, to video display of a TP that caused UUT PASSED ALL PERFORMANCE TESTS message specified in 3.3.8.

b. test all redundant circuitry separately.

c. automatically detect 100 percent of detectable faults in the UUT, including redundant circuitry (see 6.2 and 6.4.9).

d. have a test hierarchy that first causes execution of tests of internal power supplies, internal clocks, and input-output busses immediately after power application. The TP shall execute all Built In Tests (BITs) and verify proper operation of BIT and Built In Test Equipment (BITE) circuits as part of the UUT function (see 6.3.6). Subsequently, the TP shall test the least reliable assemblies, subassemblies, and components of the UUT by first seeking faults with highest probability of occurrence (see 6.3.1). Performance tests shall be run in sequence before the test program shall display a message indicating UUT PASSED ALL PERFORMANCE TESTS. The applicable message specified in 3.3.8 shall be displayed.

e. terminate with a failure message for any out of tolerance measurement. This message shall either identify the cause of failure and provide recommended maintenance action, lead an operator to additional diagnostic tests, or lead an operator to specific UUT alignment procedures. The applicable message in specified in 3.3.8 shall be displayed.

f. be performed without removing UUT covers, using UUT extender boards, or probing of the UUT.

3.4.3.3 UUT test repeatability. The TP shall allow the ATE operator to repeat or cycle each test and test condition. A UUT GOOD message shall not result if a test is repeated due to a failed performance test.

3.4.3.4 UUT diagnostics (see 6.3.5).

3.4.3.4.1 LRU fault isolation. TP diagnostic tests for a UUT identified by contract as applicable to the LRU for testing purposes shall isolate faults according to the fault isolation accuracy and ambiguity group sizes specified in table I (see 6.2, 6.3.6, 6.4.2, and 6.4.12). The TP shall isolate all faults in non-replaceable assemblies according to the fault isolation accuracy and limitations of ambiguity group sizes identified in table I. Guidance for fault isolation (FI) calculations is given in 6.4.13.

3.4.3.4.2 SRA fault isolation. TP diagnostic tests for a UUT identified by contract as applicable to the SRA for testing purposes shall cause isolation of component faults according to the fault isolation accuracy and ambiguity group sizes specified in table II (see 6.2 and 6.3.6). Non-repairable subassemblies shall be considered components. Guidance for FI calculations is given in 6.4.13.

3.4.3.5 Adjustments and alignments. The TP shall contain all adjustment and alignment procedures required to bring the UUT performance to within the limits specified in the UUT test requirements data (see 6.3.5). The TP shall show these procedures, when required to be implemented, to the operator on the ATE video display. When the TP is adjusted or aligned the TP shall return to the performance test area where the out of adjustment or alignment condition was detected. Failure to adequately correct the faulty condition shall cause the TP to begin the required diagnostic testing. The TP shall allow no more than three attempts to successfully adjust or align the UUT, prior to returning to the performance test, or allow operator discretion.

3.5 Test program hardware. The following subparagraphs delineate requirements for the TPH (see 6.4.24).

3.5.1 Nomenclature. TPH items shall be identified with the standard nomenclatures listed below.

Accessory set
Ancillary equipment
Cable assembly (set)
Holding fixture
Interface device
Test fixture

3.5.2 Identification. The following information shall be permanently identified on the ID, test fixtures, holding fixtures, and accessories.

Joint Equipment Type Designation System nomenclature (when assigned).
Part number.
National Stock Number.
Contract number.
Manufacturer's name.
Manufacturer's Commercial and Government Entity (CAGE) code.
Manufacturer's model number (if assigned by the manufacturer).
Manufacturer's serial number.

3.5.3 Markings. The following markings shall not be applied in such a way to adversely affect safety or performance.

3.5.3.1 Reference designations. Reference designators shall identify the particular circuit application for each part. Sub-miniaturized and nonrepairable assemblies need not be marked with reference designators. The graphic symbols used for reference designations shall be in accordance with IEEE-315 and the application of reference designations shall be in accordance with IEEE-200.

3.5.3.2 Warnings. Warning markings shall be used to warn of the location, nature, and extent of a hazard. Warning markings shall be applied in accordance with ISA-S82.02.01 and ISA-S82.02.02 as applicable.

3.5.3.3 Electrostatic discharge sensitive device markings. Electrostatic discharge sensitive devices within TPH items shall be marked in accordance with EIA-625.

3.5.4 TPH footprint. The TPH in any combination and any configuration, when in use with the ATE, shall be not greater than the ATE height and width, and shall not extend more than 24 inches from the front of the receiver-fixture interface (see 6.4.18).

3.5.5 Reliability. Mean-time-between-failure of the TPH, in any combination and in any configuration of TPH items necessary to comply with test, diagnosis, and alignment requirements stated herein, shall be greater than 5000 operating hours. Operating hours shall include the sum of all times the item is used for TPH hookup, tests, diagnosis, alignments, and adjustments (see 6.3.1).

3.5.6 Maintainability. TPH items shall not require periodic maintenance or calibration.

3.5.6.1 Time to repair. Maximum time to repair of each TPH item shall be not greater than 45 minutes per item, inclusive of wiring repairs. This time shall include all clock time to conduct removal of assemblies and subassemblies, component replacement actions, and incidental repair actions. Verification of successful maintenance, fault detection and isolation shall not be included in maximum time to repair calculations.

3.5.7 Electromagnetic compatibility (EMC). The TPS shall comply with the EMC requirements of MIL-PRF-28800 when tested in accordance with 4.2.4.7 (see 6.3.2).

3.5.8 ID and fixtures.

3.5.8.1 Test fixture. The size, mounting, and weight of test fixtures shall be compatible with the ATE work surface. The weight of the test fixture shall be not greater than 74 lbs.

3.5.8.2 Holding fixture. The holding fixture shall provide the means to support and restrain the UUT to prevent damage to or performance degradation of the UUT during testing (see 6.4.15). The holding fixture shall provide access for cooling if required by the UUT. The holding fixture shall have no electrical interface with the UUT, ID, or ATE. The weight of the holding fixtures shall be not greater than 74 lbs.

3.5.8.3 Interface device. The ID shall require only one person to mount it onto the ATE interface. The weight of the ID shall be not greater than 37 pounds (see 6.4.16).

3.5.8.4 ID moment of force. The ID moment shall be not greater than 600 inch-pounds at the ATE interface with the cable set, UUT, and any other required items connected.

3.5.9 Grounding. Signal ground and power ground shall be isolated in TPH items. There shall be no performance degradation of the TPS due to signal and power grounds in TPH items. Power ground paths (wire, connectors, and contacts) shall be rated for twice the current present in the TPH during UUT testing.

3.5.10 Electrical connectors. The mating connector-engaging mechanism shall lock or tighten in its fully closed position. Identical TPH connectors shall be keyed differently. Each external connector on TPH items shall be provided with an attachable or attached protective

cover. Connector placements shall not require connecting or disconnecting any adjacent connector during mate or demate action.

3.5.11 Power connector contacts. Connectors supplying power shall have female-type contacts while those receiving power shall have male-type contacts. Individual connector contacts shall be removable and replaceable without removing other contacts.

3.5.12 Cable assemblies (see 6.4.5).

3.5.12.1 Cable design. The cable design shall:

a. protect cables and wiring from breakage. Strain relief shall be provided so that the weight of a connector, or a cable assembly and connector does not damage connectors on the UUT, the ATE, or the TPH.

b. have cable connectors that are potting free.

c. not use cable ties on wire bundles within the convoluted tubing.

d. have assemblies constructed such that a minimum of three inches of wire shall be exposed between the cable covering and the connector when the connector shell is removed (see 6.3.3).

e. not have woven, braided wiring, or ribbon cable used for ID external connections.

f. be repairable by the end user using standard shop tools or special tools provided as part of the TP hardware.

g. contain no electrical components.

h. have individual wires of length and flexibility such as to prevent damage when being bent during use, repair, and storage.

i. have connector shells to protect any exposed contacts from damage when protective covers are removed.

3.5.12.2 Cable assembly branching limit. A maximum of one branch per cable assembly shall be used (see 6.4.5). The maximum number of connectors per cable assembly shall be three.

3.5.13 Wire-wrap. If wire wrap is used:

a. no more than three wires shall be wire-wrapped to an individual wire-wrap post.

b. all wire terminations shall be labeled.

c. a means shall be provided to allow repair without replacing the entire wire path (see 6.3.4).

d. cables shall be long enough to provide service loops required for repair.

3.5.14 Accessory set. Various hardware items such as any special tools, extender cards, adapters, probes, cable assemblies, indicator overlays, alignment fixtures, and other items, to support testing of UUTs on an ATE as required by the TPS, shall be identified as an accessory set and provided as part of the TPS (see 6.4.1).

3.5.15 Ancillary equipment. In addition to the TPH necessary to test the UUT, equipment shall be identified as ancillary equipment and provided as part of the TPS. Common shop equipment shall not be considered ancillary equipment (see 6.4.3).

4. VERIFICATION

4.1. Classification of inspections. The inspection requirements specified herein are classified as follows:

a. First article inspection (see 4.2).

b. Conformance inspection (see 4.3).

4.2 First article inspection. First article inspection shall be performed on one complete TPS when a first article sample is required (see 3.1). The inspection shall include the methods of inspection specified in table III, class A (see 6.4.7, 6.4.8, 6.4.11, and 6.4.20). The results of verification tests shall be recorded (see 6.2 and 6.4.14).

4.2.1 Performance characteristics. The operation of the TP shall be observed to determine compliance with the requirements of 3.2.

4.2.1.1 TPS transportability. A cycle of three ETE tests shall be performed as follows: Perform an ETE test on one known good UUT, using the TPS with the ATE. Next, perform an ETE test using the same UUT and TPS on a different serial number ATE of the same configuration, and then perform an ETE test using the TPS on a different serial number of the UUT, and an ATE of the same configuration. When a TPS is host to more than one UUT, the above cycle shall be performed for each UUT. At the conclusion of these tests the TPS shall comply with the requirements of 3.2.1.

4.2.1.2. TPS test accuracy ratio. The ability of the TPS to satisfy the TAR specified in 3.2.2 shall be confirmed or demonstrated prior to beginning first article inspection.

4.2.1.3 TPS set-up time. The elapsed time to set up the TPS shall comply with the requirements of 3.2.3.

4.2.1.4 TPS safety. The TPH shall be examined for unsafe conditions at the beginning of first article inspection. The TPH shall then be connected, used, and examined for any hazards or damage. The TPH shall comply with the requirements of 3.2.4 throughout first article inspection.

4.2.1.5 UUT and ATE integrity. The operation of the UUT and ATE shall be observed to determine compliance with the requirements of 3.2.5.

4.2.1.6 Environment. The ability of the TPS to satisfy 3.2.6 shall be confirmed or demonstrated prior to the commencement of first article inspection.

4.2.1.7 Technical architecture interface. The TP shall be examined to verify that the elements of the technical architecture that are implemented are not bypassed by direct communication to another interface or layer further in the process (see 3.2.7).

4.2.2 TP format. The TP shall be examined to confirm that ATLAS has been used and that the code complies with the requirements specified in 3.3.

4.2.2.1 Test statement numbers. The ATLAS test statement numbers shall be examined to determine compliance with the requirements specified in 3.3.1.

4.2.2.2 Variable names. The variable names used in the ATLAS code shall be examined to determine compliance with the requirements specified in 3.3.2.

4.2.2.3 ATLAS procedures. The procedure names used as part of the ATLAS code shall be examined to determine compliance with the requirements of 3.3.3.

4.2.2.4 Looping statements. The looping statements used in the ATLAS code shall be examined to determine compliance with the requirements specified in 3.3.4.

4.2.2.5 ATLAS comments.

4.2.2.5.1 Major comment header. The format used for the major comment headers and code readability shall be examined to determine compliance with the requirements specified in 3.3.5.1.

4.2.2.5.2 Minor comment header. The format used for the minor comment headers and the identification of functions shall be examined to determine compliance with the requirements of 3.3.5.2.

4.2.2.5.3 Functional comments. The format used for functional comments and code readability shall be examined to determine compliance with the requirements of 3.3.5.3.

4.2.2.5.4 Procedural comments. The format used for procedural comments and code readability shall be examined to determine compliance with the requirements of 3.3.5.4.

4.2.2.6 ATLAS preamble structure.

4.2.2.6.1 TP title block. The location, format, and content of the TP title blocks shall be examined to determine compliance with the requirements of 3.3.6.1.

4.2.2.6.2 UUT configuration data. The location, format, and content of the UUT configuration data shall be examined to determine compliance with the requirements of 3.3.6.2.

4.2.2.6.3 TP configuration data. The location, format, and content of the TP configuration data shall be examined to determine compliance with the requirements of 3.3.6.3.

4.2.2.6.4 Entry point directory. The location, format, and content of the EPD shall be examined to determine compliance with the requirements of 3.3.6.4.

4.2.2.6.5 ATLAS include statements. The location, format, and content of the ATLAS include statements shall be examined to determine compliance with the requirements of 3.3.6.5.

4.2.2.6.6 ATLAS require statements. The location, format, and content of the ATLAS require statements shall be examined to determine compliance with the requirements of 3.3.6.6.

4.2.2.6.7 ATLAS variable declarations. The location, format, and content of the ATLAS variable declarations shall be examined to determine compliance with the requirements of 3.3.6.7.

4.2.2.6.8 Interface definitions. The location, format, and content of the ATLAS interface definitions shall be examined to determine compliance to the requirements of 3.3.6.8.

4.2.2.6.9 ATLAS fill statements. The location, format, and content of the ATLAS fill statements shall be examined to determine compliance with the requirements of 3.3.6.9.

4.2.2.6.10 ATLAS message definitions. The location, format, and content of the ATLAS message definitions shall be examined to determine compliance with the requirements of 3.3.6.10.

4.2.2.6.11 ATLAS procedure definitions. The location, format, and content of the ATLAS procedure definitions shall be examined to determine compliance with the requirements of 3.3.6.11.

4.2.2.7 UUT verification section. The location, format, and content of the ATLAS verification section shall be examined to determine compliance with the requirements of 3.3.7.

4.2.2.7.1 TPH tests. The location, format, and content of the TPH tests shall be examined to determine compliance with the requirements of 3.3.7.1.

4.2.2.7.2 UUT tests. The location, format, and content of the UUT tests shall be examined to determine compliance with the requirements of 3.3.7.2.

4.2.2.8 Standard messages. Standard messages shall be examined to determine compliance with the requirements of 3.3.8.

4.2.3 Software.

4.2.3.1 Demonstration of TPS software.

4.2.3.1.1 TP menu. The operation of the TP menu shall be verified using the following method: One ETE test shall be selected from the TP menu along with a test for one of the individual test blocks. After selection of the tests, the test modules shall be executed and the output observed to confirm that the TP has returned to the menu when no faults are detected or after execution of any selected individual test module. A TP termination module shall then be selected and the operation of the TP shall be observed to confirm that all power, stimulus, and measurement connections are removed subsequent to termination. Throughout these tests the TP shall comply with the requirements specified 3.4.1.1.

4.2.3.1.2 Printing option. The operation of the automatic printing option of the TPS shall be verified by printing test results and messages specified in 3.4.1.2.

4.2.3.1.3 Messages. The ability of the TPS to provide messages shall be verified by confirming that the messages displayed on the TPS provide information on the TPS and ATE and that warning or caution messages precede all unsafe or hazardous conditions as specified in 3.4.1.3.

4.2.3.1.4 Graphics. The operation of the graphics display shall be verified using the following method: The graphics display shall be observed to confirm that it shows all adjustments, alignments, test points, and any interconnect and test set-up diagrams, as specified in 3.4.1.4.

4.2.3.2 TPH software.

4.2.3.2.1 TPH pre-performance tests. The ability of the TPH software to perform the TPH pre-performance tests shall be verified by using the following method: Run the TPH pre-performance tests and observe that the TPH connections, and all hardware are displayed and identified. Apply a fault condition and verify that the TP does not continue to operate and that the TP notifies the operator of an incorrect TPH signature test configuration. Next, provide a correct TPH signature test configuration to verify that the TP continues to operate and notifies

the operator of a correct signature test configuration. Provide any fault condition applicable to the TPH STTO test to verify that the TP does not continue to operate and notifies the operator of an incorrect STTO configuration. Remove the fault condition and observe that the TP notifies the operator of a correct STTO, and that the TP continues operation. Throughout the TPH pre-performance tests the TPH shall conform with the requirements of 3.4.2.1.

4.2.3.2.2 TPH performance tests. The ability of the TPH software to perform the TPH pre-performance tests shall be verified by using the following method: Run each of the TPH performance tests modules and record the run time interval. Connect the applicable test wraparound shorting plugs and execute the test wraparound module. Insert directed faults into the TPH, including wire paths, and observe that they are detected. Run the TPH performance tests and observe that the circuitry for each UUT can be tested separately. Observe that the tests can be performed without removing covers, using extender boards or probing and that no additional ID is required. Throughout the TPH performance tests the TPH shall conform with the requirements of 3.4.2.2.

4.2.3.2.3 TPH test repeatability. After each test is repeated or cycled the TPH shall be observed to confirm that it does not display a TPH GOOD after a failed performance test and that the TPH complies with the requirements of 3.4.2.3.

4.2.3.2.4 TPH programmable parts. The TPH shall comply with the requirements specified in 3.4.2.4 when any of its programmable TPH components are erased and reprogrammed.

4.2.3.2.5 TPH diagnostics test. The TPH shall comply with the requirements of 3.4.2.5 when directed faults are inserted into the TPH.

4.2.3.3 UUT software.

4.2.3.3.1 UUT pre-performance tests. The ability of the UUT software to perform the UUT pre-performance tests shall be verified using the following method: Use the displayed video to connect the UUT, TPH, and ATE. Provide a fault condition to verify that the TP does not continue and notifies the operator of an incorrect UUT signature test configuration. Provide a correct UUT signature test configuration to verify that the TP continues to operate and notifies the operator of a correct signature test configuration. Provide a fault condition to verify that the TP does not continue to operate and notifies the operator of an incorrect UUT STTO configuration. Remove the fault condition and observe that the applicable notification of a correct STTO is displayed and that the TP continues to operate (see 3.4.3.1).

4.2.3.3.2 UUT performance tests. The ability of the UUT software to perform the UUT performance tests shall be verified using the following method: Run the ETE and measure the time. Use the TP to test the redundant circuitry. Insert directed faults into the UUT and run the UUT performance tests. Run the TP and observe that: internal power supplies, internal clocks, and input-output buses are immediately tested after power is applied; the BIT is executed and

verified; the least reliable items are tested early in the TP; a GO PATH sequence occurs before a UUT PASSED ALL PERFORMANCE TESTS message is displayed (see 3.4.3.2).

4.2.3.3.3 UUT test repeatability. After each test is repeated or cycled the UUT shall comply with the requirements of 3.4.3.3.

4.2.3.3.4 UUT diagnostics.

4.2.3.3.4.1 LRU fault isolation. Directed faults shall be inserted into the UUT to verify the ambiguity group sizes at the percentage of faults and to determine compliance with the requirements of 3.4.3.4.1.

4.2.3.3.4.2 SRA fault isolation. Directed faults shall be inserted into the UUT to verify the ambiguity group sizes at the percentage of faults and to determine conformance with the requirements of 3.4.3.4.2.

4.2.3.4 Adjustments and alignments. Directed errors shall be inserted into the UUT to verify that the adjustment and alignment procedures are in order and to determine conformance with the requirements of 3.4.3.5.

4.2.4 Hardware.

4.2.4.1 Nomenclature. The nomenclature shall be examined to determine compliance with the requirements of 3.5.1.

4.2.4.2 Identification. The identification of the TPS shall be examined to determine compliance with the requirements of 3.5.2.

4.2.4.3 Markings.

4.2.4.3.1 Reference designations. The reference designations on the TPS shall be examined to determine compliance with the requirements of 3.5.3.1.

4.2.4.3.2 Warnings. The warning markings on the TPS shall be examined to determine compliance with the requirements of 3.5.3.2.

4.2.4.3.3 Electrostatic discharge sensitive device markings. The electrostatic discharge sensitive markings shall be examined to determine compliance with the requirements of 3.5.3.3.

4.2.4.4 TPH footprint. The overall height, width, and length of the TPH, when it is connected to the ATE, shall be examined to determine compliance with the requirements of 3.5.4.

4.2.4.5 Reliability. The ability of the of the TPH to satisfy 3.5.5 shall be confirmed or demonstrated at first article inspection.

4.2.4.6 Maintainability. The ability of the of the TPH to satisfy 3.5.6 shall be confirmed or demonstrated prior to the commencement of first article inspection.

4.2.4.6.1 Time to repair. The TPH shall comply with the requirements of 3.5.6 and 3.5.6.1 when a defective unit is repaired and the repair time is measured.

4.2.4.7 Electromagnetic compatibility. The TPS shall be subjected to the EMC test and limits specified in MIL-PRF-28800. The measuring equipment setup, procedures, and operation of the TPS being tested shall be in accordance with IEC-CISPR-11 class A, IEC-61000-4-2, IEC-61000-4-3, IEC-61000-4-4, and IEC-61000-4-6 (see 3.5.7).

4.2.4.8 ID and fixtures.

4.2.4.8.1 Test fixture. The compliance of the test fixture with the requirements of 3.5.8.1 shall be verified using the following method: Examine the test fixture for compatibility with the ATE work surface mounting holes. Weigh the test fixture to verify the weight is 74 ± 0.5 pounds or less. Have two typical operating personnel lift the test fixture and mount it on the work surface (see 6.4.29).

4.2.4.8.2 Holding fixture. The compliance of the holding fixture with the requirements of 3.5.8.2 shall be verified using the following method: Weigh the holding fixture to verify the weight is 74 ± 0.5 pounds or less. Two typical operating personnel shall lift the holding fixture and mount it on the work surface (see 6.4.29). Verify that the UUT can be supported and restrained without damage or performance degradation. Verify that there is access for cooling if required and that there are no electrical connectors to the UUT, ID, or ATE.

4.2.4.8.3 Interface device. The compliance of the holding fixtures with the requirements of 3.5.8.3 shall be verified using the following method: Weigh the ID to verify the weight is 37 ± 0.5 pounds or less. A typical operating person shall lift the ID and mount it on the ATE interface (see 6.4.29).

4.2.4.8.4 ID moment of force. The ability of the ID to satisfy the moment of force requirements specified in 3.5.8.4 shall be confirmed or demonstrated at first article inspection.

4.2.4.9 Grounding. The compliance of the TPH with the requirements of 3.5.9 shall be verified using the following method: Measure the resistance between signal and power ground to ensure isolation. Observe the TPS for erroneous performance. The power ground paths of the TPH shall also be confirmed or demonstrated to be the maximum current rating.

4.2.4.10 Electrical connectors. The keying of the electrical connectors shall be examined to determine compliance with 3.5.10.

4.2.4.11 Power connector contacts. The compliance of the TPH with the requirements of 3.5.11 shall be verified using the following method: Verify that power supply connectors have female-type contacts and receiving power contacts have male-type connectors. Verify that individual connector contacts can be removed and replaced without removing other contacts.

4.2.4.12 Cable assembly.

4.2.4.12.1 Cable design. Each cable assembly shall be examined for compliance with the requirements of 3.5.12.1 by observing the lengths, flexibility, and durability of the cables in use, repair, and storage.

4.2.4.12.2 Cable assembly branching limit. Each cable assembly shall be examined for compliance with the requirements of 3.5.12.2 by verifying that there is no more than one branch per cable assembly, and a maximum of three connectors in a cable assembly.

4.2.4.13 Wire-wrap. Each cable assembly shall be examined for compliance with the requirements of 3.5.13 by verifying that no more than three wires are wrapped to an individual post, that all wire terminations are labeled.

4.2.4.14 Accessory set. Each accessory set shall be examined for compliance with the requirements of 3.5.14.

4.2.4.15 Ancillary equipment. The ancillary equipment shall be examined for compliance with the requirements of 3.5.15.

4.3 Conformance inspection. Conformance inspection shall include the methods of inspection listed in table III, class B.

4.3.1 Initial production lot inspection. A unit of the first production lot shall be subjected to inspections of 4.2.1 through 4.2.4.15.

4.3.2 Subsequent unit inspection. Verification requirements of subsequent production units are as specified below.

4.3.2.1 TPH tests.

4.3.2.1.1 TPH pre-performance tests. The TPH shall be tested in accordance with 4.2.3.2.1 to determine compliance with the requirements of 3.4.2.1.

4.3.2.1.2 TPH performance tests. The TPH shall be tested in accordance with 4.2.3.2.2 to determine compliance with the requirements of 3.4.2.2.

4.3.2.2 UUT tests.

4.3.2.2.1 UUT hookup procedure. The UUT shall be tested in accordance with 4.2.3.3.1 to determine compliance with the requirements of 3.4.3.1.a.

4.3.2.2.2 UUT signature test. The UUT shall be tested in accordance with 4.2.3.3.1 to determine compliance with the requirements of 3.4.3.1.b.

4.3.2.2.3 UUT STTO. The UUT shall be tested in accordance with 4.2.3.3.1 to determine compliance with the requirements of 3.4.3.1.c.

4.3.2.3 Hardware.

4.3.2.3.1 Nomenclature. The TPS shall be examined to determine compliance with the requirements of 3.5.1.

4.3.2.3.2 Identification. The TPS shall be examined to determine compliance with the requirements of 3.5.2.

4.3.2.3.3 Markings.

4.3.2.3.3.1 Reference designations. The TPS shall be examined to determine compliance with the requirements of 3.5.3.1.

4.3.2.3.3.2 Warnings. The TPS shall be examined to determine compliance with the requirements of 3.5.3.2.

4.3.2.3.3.3 Electrostatic discharge sensitive device. The TPS shall be examined to determine compliance with the requirements of 3.5.3.3.

4.3.2.3.3.4 Electromagnetic interference. The TPS shall be tested in accordance with 4.2.4.7 to determine compliance with the requirements of 3.5.7.

4.3.2.3.3.5 Electrical connectors. The keying of electrical connectors shall be examined to determine compliance with the requirements of 3.5.10.

4.3.2.3.6 Power connector contacts. Power connector contacts shall be examined in accordance with 4.2.4.11 to determine compliance with the requirements of 3.5.11.

4.3.2.3.7 Cable assembly.

4.3.2.3.7.1 Cable design. The cable design shall be examined in accordance with 4.2.4.12.1 to determine compliance with the requirements of 3.5.12.1.

4.3.2.3.7.2 Cable assembly branching limit. The branching of cable assemblies shall be examined in accordance with the requirements of 4.2.4.12.2 to determine compliance with the requirements of 3.5.12.2.

4.3.2.3.8 Wire-wrap. The wire-wrap shall be examined in accordance with 4.2.4.13 to determine compliance with the requirements of 3.5.13.

4.3.2.3.9 Accessory set. The accessory set shall be examined in accordance with 4.2.4.14 to determine conformance with the requirements of 3.5.14.

4.3.2.3.10 Ancillary equipment. The ancillary equipment shall be examined in accordance with 4.2.4.15 to determine conformance with the requirements of 3.5.15.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.)

6.1 Intended use. TPSs consist of software, hardware, and operating instructions and are intended to be used with Government furnished ATE for testing, diagnosing, adjusting, and aligning the UUTs. Military systems are tested and diagnosed using a combination of ATE and TPSs. TPSs are used in the maintenance of military avionics, weapon systems, and ground based equipment and do not have commercial applications.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this specification.

b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 and 2.3).

c. When first article is required (see 3.1).

d. The electromagnetic interference, shock, and vibration requirements of the ATE (see 3.2.6).

e. If the UUT performance tests are required to automatically detect 100 percent of detachable faults in the UUT (see 3.4.3.2.c).

f. The TP tests identified as applicable to the LRU for testing purposes (see 3.4.3.4.1).

g. The TP tests identified as applicable to the SRA for testing purposes (see 3.4.3.4.2).

h. How the results of the verification tests are to be recorded (see 4.2).

i. Packaging requirements (see 5.1).

6.3 Successful techniques. In satisfying the requirements of section 3, the following non-binding guidance may be helpful.

6.3.1 Reliability and test hierarchy. Faults with the highest probability of occurrence may be derived from UUT Failure Mode, Effects and Analysis (FMEA) or other available UUT reliability data (see 3.4.3.2.d and 3.5.5).

6.3.2 Electromagnetic interference (EMI). EMI shielding gaskets may be used on TPH enclosure covers. TPH enclosure covers containing wire mesh screens for cooling may also provide EMI shielding. Connectors may incorporate a conductive elastomer (see 3.5.7).

6.3.3 Cable assemblies. Cables with multiple pin connectors may be protected by annular convolution type tubing. Cable outer jackets may be attached to connector shells by a screw-on coupling (see 3.5.12.1.d).

6.3.4 Wire-wrap. In the past, service loops were used to allow repair without replacing the entire wire path (see 3.5.13.c).

6.3.5 UUT diagnostics. Removal of UUT covers, use of UUT extender boards, or probing of the UUT is permitted during diagnostic testing of the UUT (see 3.4.3.4 and 3.4.3.5).

6.3.6 Built in test (BIT). BITs are permitted to be used for fault detection and isolation. If a BIT is used the TP should display the applicable message of 3.3.8 when a known fault is applied to the TP (see 3.4.3.2.d, 3.4.3.4.1, and 3.4.3.4.2).

6.4 Definitions. MIL-STD-1309 was used as a guide in preparation of the following definitions:

6.4.1 Accessory set. Various hardware items such as any special tools, extender cards, adapters, probes, cable assemblies, indicator overlays, alignment fixtures, and other items, to support testing of UUTs on an ATE as required by the TPS (see 3.5.1 and 3.5.14).

6.4.2 Ambiguity group. A group of replaceable items which may have faults resulting in the same fault signature or the group of items to which a given fault is isolated, any of which could be the actual fault item (see 3.4.3.4.1).

6.4.3 Ancillary equipment. Equipment external to test program hardware required to complete testing of a UUT, and specifically required for a UUT TPS (for example, a load assembly). Common shop equipment is not ancillary equipment (see 3.5.1 and 3.5.15).

6.4.4 ATE survey test. A test designed to check that the ATE resources required by the TPS are present. The ATE survey test is normally an optional test, performed at the operator's discretion (see 3.3.1.a).

6.4.5 Cable assembly. A specifically designed item, with or without branches, having one or more ends processed or terminated in fittings for use between UUTs, ATE, and IDs (see 3.5.12.1 and 3.5.12.2).

6.4.6 Cable assembly set. A grouping of items, having the same basic name, for use with two or more cable assemblies (see 3.5.1).

6.4.7 Certification. Verification that a support test system is capable, at the time of certification demonstration, of correctly assessing the quality of the items to be tested. This verification is based on an evaluation of all support test system elements and establishment of acceptable correlation among similar test systems (see 4.2).

6.4.8 Demonstration. An element of verification which generally denotes the actual operation, adjustment, or re-configuration of items to provide evidence that the designed functions were accomplished under specific scenarios. The items may be instrumented and quantitative limits of performance monitored (see 4.2).

6.4.9 Detectable fault. A fault which causes failure mode which degrades UUT operational performance beyond tolerance limits (see 3.4.3.2.c).

6.4.10 Diagnostic tests. A set of tests that isolate and identify faults detected by the performance tests (see 3.3.1.e and 3.3.5.2).

6.4.11 Examination. An element of verification and inspection consisting of investigation of items without use of special laboratory appliances or procedures, to determine conformance to those specified requirements which can be determined by such investigations. Examination is generally nondestructive and typically includes the use of sight, hearing, smell, touch, and taste; simple physical manipulation; mechanical and electrical gauging and measurement; and other forms of investigation (see 4.2).

6.4.12 Fault. Degradation outside of normal performance limits on UUT operation due to maladjustment, misalignment, component tolerance drift, or a failure of a component(s) (see 3.4.3.4.1).

6.4.13 Fault isolation (FI) percentages. FI is the number of ambiguity groups with n items divided by the total number of ambiguity groups (see 3.4.3.4.1, 3.4.3.4.2, and 6.4.2). The size of a group is determined by quantity of items within a group. Items are subassemblies or components, depending on level of fault isolation required for the UUT. The following formula will be used for calculating the FI:

$$FI_n = FI_{n-1} + \frac{\text{Number of ambiguity groups with n items}}{\text{Total number of ambiguity groups}} X 100\%$$

Diagnostic percentages for this example are in table IV.

For example, if a TP has 184 ambiguity groups of 1 item, 10 ambiguity groups of 2 items, and 6 ambiguity groups of 3 items. Total number of ambiguity groups is 184 + 10 + 6 = 200.

For groups with 1 item, FI_1 = [0 + (184 groups/200 groups)] X 100% = 92%

For groups with 2 items, FI_2 = [0.92 + (10 groups/200 groups)] X 100% = 97%

For groups with 3 items, FI_3 = [0.97 + (6 groups/200 groups)] X 100% = 100%

6.4.14 First article. Pre-production models, initial production samples, test samples, first lots, pilot lots, and pilot models (see 4.2).

6.4.15 Holding fixture. A specifically designed hardware device used to maintain proper positioning of a UUT during testing on ATE (see 3.5.8.2).

6.4.16 Interface device. A device that provides required mechanical, electrical, hydraulic, pneumatic, radiated, or optical interconnections between a UUT and ATE to allow execution of the test program (see 3.5.8.3).

6.4.17 Performance tests. A test of tests that automatically detect and identify the presence of all detectable faults, misalignments, or misadjustments (see 3.3.5.2).

6.4.18 Receiver fixture interface. This interface provides the means to accomplish the mechanical and electrical connections between the UUT stimulus/response signals passing through the UUT's unique ID and the signals to and from the ATE test instrumentation. These signals are applied directly to the ATE test instrument or through an ATE hardware switch (see 3.5.4).

6.4.19 Shop replaceable assembly. The term SRA in table II means next lower replaceable assembly whether plug-in, chassis mounted, or hard wired (see 3.4.3.2.a).

6.4.20 Test. A procedure or action taken to determine under real or simulated conditions the capabilities, limitations, characteristics, effectiveness, reliability or suitability of a material, device, system or method (see 3.4.2.2, 3.4.3.2, and 4.2).

6.4.21 TAR. The maximum permitted error of the unit to be measured or calibrated divided by the known error of the measuring or generating device used to perform the measurement. For example, if it is required that a system or equipment output parameter be accurate to 8 percent (maximum permitted error) and a known accuracy (maximum known error) of the measuring device used to measure the output parameter is 2 percent, then the TAR is 4 (see 3.2.2).

6.4.22 Test fixture. A fixture that provides additional circuitry to resolve incompatibilities between a UUT and an ATE, which is not appropriate for inclusion in an ID due to weight, size, or heat limitations. It may also be used as a holding fixture to secure a UUT (see 3.5.1).

6.4.23 Test program. A coded sequence, when executed by an ATE, that causes UUT stimuli; causes measurements of UUT responses; causes detection of UUT faults to required levels; causes isolation of UUT faults to required levels; and causes alignment procedures for faults correction (see 3.3). The test program is formatted to provide uniformity in the functionality and appearance of the TP.

6.4.24 Test program hardware. Various hardware items required by a TPS to function. These may include an ID, or a combination of an ID, cable assembly (set), test fixture(s), holding fixture(s), accessories, and ancillary equipment (see 3.5).

6.4.25 Test program set. A collection of hardware, software, and applicable documentation used for testing, fault detection and isolation, maintenance, and any other evaluations of components and equipment (see 1.1, 3.2.1, and 6.1).

6.4.26 Test set-up time. The time required for setting up the ATE/TPH/TPS configuration for testing a UUT (see 3.2.3).

6.4.27 TP title block. The TP title block is a section of comments, which identifies the source listing (see 3.3.6.1).

6.4.28 TPS transportability. The capability of executing a TPS on all ATE of the same configuration, or on other ATE configurations that include the sufficient instrumentation to execute the TPS testing (see 3.2.1).

6.4.29 Typical operating personnel. Typical operating persons or personnel are senior personnel with a maintenance background. They are trained to operate the ATE. They have developed skills and experience related to the ATE/TPS under their cognizance. They can research, read and interpret manuals, data and drawings, and write with clarity and technical accuracy. The technical manuals described in MIL-DTL-81927 (AS) may be used as guidance for comprehensibility and readability in preparing test program software and instructions contained in the TP (see 3.2, 4.2.4.8.2, and 4.2.4.8.3).

6.4.30 UUT configuration data. The section of comments, preceded by a major comment header, which lists all of the configuration data packages used to provide relevant UUT source data during the development of the TPS (see 3.3.6.2).

6.4.31 UUT firmware. Software that is installed on a device in the UUT as read-only computer instructions (see 3.2.5).

6.5 Subject term (key word) listing.

Automatic test equipment
Interface device
Test program hardware
Test program software
Unit under test

CONCLUDING MATERIAL

Custodians:
Army - AR
Navy - AS
Air Force - 82

Review activities:
Army - AV
Navy - MC
Air Force - 02,10, 11, 13, 71, 80, 84

Preparing activity:
Navy - AS

(Project ATTS-9701)

TABLE I. LRU fault isolation.

Percentage of faults	Ambiguity group sizes
100	≤3 SRAs
95	≤2 SRAs
90	= 1 SRA

TABLE II. SRA fault isolation.

Percentage of faults	Ambiguity group sizes with	
	≤10 Components on SRA	> 10 Components on SRA
100	≤4	≤7
95	≤3	≤5
80	≤2	≤3

TABLE III. Requirement/verification cross reference matrix.

Requirement	Title	Method 1/			Class 2/		Verification
		1	2	3	A	B	
3.2	Performance characteristics	X	X		X		4.2.1
3.2.1	TPS transportability			X	X		4.2.1.1
3.2.2	TPS test accuracy ratio	X			X		4.2.1.2
3.2.3	TPS set-up time		X		X		4.2.1.3
3.2.4	TPS safety		X		X		4.2.1.4
3.2.5	UUT and ATE integrity	X			X		4.2.1.5
3.2.6	Environment	X			X		4.2.1.6
3.2.7	Technical architecture interface		X		X		4.2.1.7
3.3	Test program format		X		X		4.2.2
3.3.1	Test statement numbers		X		X		4.2.2.1
3.3.2	Variable names		X		X		4.2.2.2
3.3.3	ATLAS procedures		X		X		4.2.2.3
3.3.4	Looping statements		X		X		4.2.2.4
3.3.5.1	Major comment header		X		X		4.2.2.5.1
3.3.5.2	Minor comment header		X		X		4.2.2.5.2
3.3.5.3	Functional comments		X		X		4.2.2.5.3
3.3.5.4	Procedural comments		X		X		4.2.2.5.4
3.3.6.1	TP title block		X		X		4.2.2.6.1
3.3.6.2	UUT configuration data		X		X		4.2.2.6.2
3.3.6.3	TP configuration data		X		X		4.2.2.6.3
3.3.6.4	Entry point directory		X		X		4.2.2.6.4
3.3.6.5	ATLAS include statement		X		X		4.2.2.6.5

TABLE III. Requirement/verification cross reference matrix - Continued

Requirement	Title	Method 1/			Class 2/		Verification
		1	2	3	A	B	
3.3.6.6	ATLAS require statement		X		X		4.2.2.6.6
3.3.6.7	ATLAS variable declarations		X		X		4.2.2.6.7
3.3.6.8	Interface definitions		X		X		4.2.2.6.8
3.3.6.9	ATLAS fill statements		X		X		4.2.2.6.9
3.3.6.10	ATLAS message definitions		X		X		4.2.2.6.10
3.3.6.11	ATLAS procedure definitions		X		X		4.2.2.6.11
3.3.7	UUT verification section		X		X		4.2.2.7
3.3.7.1	TPH tests		X		X		4.2.2.7.1
3.3.7.2	UUT tests		X		X		4.2.2.7.2
3.3.8	Standard messages		X		X		4.2.2.8
3.4.1.1	TP menu	X			X		4.2.3.1.1
3.4.1.2	Printed information	X			X		4.2.3.1.2
3.4.1.3	Messages	X			X		4.2.3.1.3
3.4.1.4	Graphics	X			X		4.2.3.1.4
3.4.2.1	TPH pre-performance tests	X			X	X	4.2.3.2.1
3.4.2.2	TPH performance tests	X		X	X	X	4.2.3.2.2
3.4.2.3	TPH test repeatability	X			X		4.2.3.2.3
3.4.2.4	TPH programmable parts		X		X		4.2.3.2.4
3.4.2.5	TPH diagnostic tests			X	X		4.2.3.2.5
3.4.3.1	UUT pre-performance tests	X			X	X	4.2.3.3.1
3.4.3.2	UUT performance tests	X			X		4.2.3.3.2
3.4.3.3	UUT test repeatability	X			X		4.2.3.3.3
3.4.3.4.1	LRU fault isolation			X	X		4.2.3.3.4.1
3.4.3.4.2	SRA fault isolation			X	X		4.2.3.3.4.2
3.4.3.5	Adjustments and alignments			X	X		4.2.3.4
3.5.1	Nomenclature		X		X	X	4.2.4.1
3.5.2	Identification		X		X	X	4.2.4.2
3.5.3.1	Reference designations		X		X	X	4.2.4.3.1
3.5.3.2	Warnings		X		X	X	4.2.4.3.2
3.5.3.3	Electrostatic discharge sensitive device markings		X		X	X	4.2.4.3.3
3.5.4	TPH footprint	X			X		4.2.4.4
3.5.5	Reliability	X			X		4.2.4.5
3.5.6	Maintainability	X			X		4.2.4.6
3.5.6.1	Time to repair			X	X		4.2.4.6.1
3.5.7	Electromagnetic compatibility			X	X	X	4.2.4.7
3.5.8.1	Test fixture	X	X		X		4.2.4.8.1

TABLE III. Requirement/verification cross reference matrix - Continued

Requirement	Title	Method 1/			Class 2/		Verification
		1	2	3	A	B	
3.5.8.2	Holding fixture	X	X		X		4.2.4.8.2
3.5.8.3	Interface device	X			X		4.2.4.8.3
3.5.8.4	ID moment of force	X			X		4.2.4.8.4
3.5.9	Grounding	X		X	X		4.2.4.9
3.5.10	Electrical connectors		X		X	X	4.2.4.10
3.5.11	Power connector contacts		X		X	X	4.2.4.11
3.5.12.1	Cable design		X		X	X	4.2.4.12.1
3.5.12.2	Cable assembly branching limit		X			X	4.2.4.12.2
3.5.13	Wire-wrap		X		X	X	4.2.4.13
3.5.14	Accessory set		X		X	X	4.2.4.14
3.5.15	Ancillary equipment		X		X	X	4.2.4.15

1/ Methods of verification: 1 - Demonstration
2 - Examination
3 - Test

2/ Classes of verification: A - First article inspection
B - Conformance inspection

TABLE IV. Example diagnostic percentages.

Diagnostic percentages	Ambiguity group sizes
100	$\leq$ 3 Items
97	$\leq$ 2 Items
92	= 1 Item

```
************************************************************
*                                                          *
*                  (comment text goes here)                *
*                                                          *
************************************************************
```

FIGURE 1. Major comment header.

***** (comment text goes here) *****

FIGURE 2. Minor comment header.

```
*****  The requirement is for a 2.0 volt,                  *****
*****  4 msec pulse with a repetition period               *****
*****  of 1 second applied to P1-66. The                   *****
*****  automatic frequency generator                       *****
*****  cannot be programmed  for this                      *****
*****  duty cycle. Therefore, two automatic                *****
*****  frequency generators will                           *****
*****  be used to produce the desired input                *****
*****  to P1-66. One automatic frequency                   *****
*****  generator will be programmed                        *****
*****  for a 1 Hz rate and its sync-out output             *****
*****  will be used to trigger the second                  *****
*****  automatic frequency generator                       *****
```

FIGURE 3. Functional comment example.

```
*************************************************************
*                                                           *
*          ******************************                   *
*          *                            *                   *
*          *       PROGRAM 12345678     *                   *
*          *                            *                   *
*          ******************************                   *
*               TEST PROGRAM FOR THE                        *
*               (UUT NOMENCLATURE)                          *
*               (UUT REIVSION LEVEL)                        *
*               COMPONET OF THE                             *
*               (LRU IF APPLICABLE)                         *
*               (WEAPON SYSTEM NOMENCLATURE)                *
*               (WEAPON SYSTEM NAME)                        *
*               UUT ASSEMBLY NUMBER                         *
*                    P/N 12345678                           *
*************************************************************
```

FIGURE 4. Test program title block.

UUT CONFIGURATION DATA

DRAWING NO.	REV.	DATE	TYPE
12345678	ORIG	1/25/98	ASSEMBLY
12347890	A	1/31/98	SCHEMATIC
12348905	D	2/10/98	MIL SPEC

FIGURE 5. UUT configuration data.

****

*

* TEST PROGRAM CONFIGURATION DATA *

*

****

REVISION	DATE	PROGRAMMER	REASON FOR CHANGE
01	1/28/98	C. SMITH	REVISED PER ECN J65571
02	2/20/98	C. SMITH	REVISED PER ECP 1229
03	3/15/99	J. DOE	REVISED PER ECP 1288

FIGURE 6. Test program configuration data.

****

* TPS MAINTENANCE ENTRY POINT DIRECTORY *

* *

* ENTRY POINT APPLICATION *

* 010000 UUT IDENTIFICATION *

* 100000 ATE SURVEY TEST *

* 150100 ID CONNECTION *

* 150200 ID SURVEY TESTS *

* 200000 UUT CONNECTION *

* 200200 UUT STTO TESTS *

* 201000 UUT STATIC TESTS *

* 210100 (PERFORMANCE TEST #1) *

* 210200 (PERFORMANCE TEST #2) *

****

FIGURE 7. EPD example.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7, and send to preparing activity.

3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-32070	2. DOCUMENT DATE (*YYYYMMDD*) 20020130

3. DOCUMENT TITLE
TEST PROGRAM SETS

4. NATURE OF CHANGE (*Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.*)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (*Last, First, Middle Initial*)	b. ORGANIZATION	
c. ADDRESS (*Include ZIP Code*)	d. TELEPHONE (*Include Area Code*) (1) Commercial (2) DSN (*If applicable*)	**7. DATE SUBMITTED** (*YYYYMMDD*)

8. PREPARING ACTIVITY

a. NAME COMMANDER NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION	b. TELEPHONE (*Include Area Code*) (1) Commercial (732) 323-2947 (2) DSN 624-2947
c. ADDRESS (*Include ZIP Code*) CODE 414100B120-3 HIGHWAY 547 LAKEHURST, NJ 08733-5100	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman Road, Suite 2533 Fort Belvoir, Virginia 22060-6221 Telephone (703) 767-6888 DSN 427-6888